

CLAIMS

1. A tissue repair implant comprising:
a tissue carrier matrix comprising a plurality of biocompatible, bioresorbable granules and at least one tissue fragment in association with the tissue carrier matrix, the at least one tissue fragment having an effective amount of viable cells that can migrate out of the tissue fragment and populate the tissue carrier matrix.
2. The implant of claim 1, wherein the tissue carrier matrix is in the form of an injectable suspension.
3. The implant of claim 1, wherein the at least one tissue fragment is obtained from a connective tissue type selected from the group consisting of cartilage, meniscus, tendon, ligament, dermis, bone, fat, and combinations thereof.
4. The implant of claim 1, wherein the at least one tissue fragment comprises autogeneic tissue, allogeneic tissue, xenogeneic tissue, and combinations thereof.
5. The implant of claim 1, wherein the at least one tissue fragment has a particle size in the range of about 0.1 to about 2 mm³.
6. The implant of claim 1, wherein the granules comprise a biocompatible material selected from the group consisting of aliphatic polyesters, copoly(ether-esters), solid copolymers of fatty acid esters of glycerol and succinic acid, polyoxaesters, collagen, gelatin, albumin, hyaluronate, glucosaminoglycans, polyanhydrides, polyphosphazines, subintestinal mucosa, acellular tissues, and combinations thereof.
7. The implant of claim 6, wherein the granules comprise an aliphatic polyester selected from the group consisting of homopolymers or copolymers of lactides, glycolides, ϵ -caprolactone, p-dioxanone (1,4-dioxan-2-one), trimethylene carbonate (1,3-dioxan-2-one), and combinations thereof.

8. The implant of claim 1, wherein an average maximum outer diameter of the granules is in the range of about 150 to about 600 μm .
9. The implant of claim 1, wherein the granules are porous.
10. The implant of claim 1, wherein the granules have a surface roughness to facilitate attachment to tissue.
11. The implant of claim 1, further including a binding agent in association with the tissue carrier matrix.
12. The implant of claim 11, wherein the binding agent is selected from the group consisting of shark cartilage, alginate, hyaluronic acid, collagen gel, fibrin glue, fibrin clot, poly(N-isopropylacrylamide), agarose, chitin, chitosan, cellulose, polysaccharides, poly(oxyalkylene), a copolymer of poly(ethylene oxide)-poly(propylene oxide), poly(vinyl alcohol), polyacrylate, platelet rich plasma (PRP) clot, platelet poor plasma (PPP) clot, Matrigel, blood clot, gelatin-resorcin-formalin adhesives, mussel-based adhesives, dihydroxyphenylalanine (DOPA) based adhesives, transglutaminase, poly(amino acid)-based adhesives, cellulose-based adhesives, polysaccharide-based adhesives, synthetic acrylate-based adhesives, liquid and semi-solid fatty acid esters of glycerol and succinic acid (MGSA), MGSA/polyethylene glycol (MGSA/PEG) copolymers, polyvinylpyrrolidone (PVP), PVP copolymers, gelatin, albumin, monoglycerides, diglycerides, triglycerides laminin, elastin, proteoglycans, and combinations thereof.
13. The implant of claim 11, further including a curing agent that crosslinks the binding agent to enable the implant to set.
14. The implant of claim 13, wherein the curing agent is selected from the group consisting of thrombin, calcium, divinyl sulfone (DVS), polyethylene glycon divinyl sulfone (VS-PEG-VS), hydroxyethyl methacrylate divinyl sulfone (HEMA-DIS-HEMA), formaldehyde, glutaraldehyde, aldehydes, isocyanates, alkyl and aryl halides, imidoesters, N-substituted

maleimides, acylating compounds, carbodiimide, hydroxychloride, N-hydroxysuccinimide, light, pH, temperature, metal ions, and combinations thereof.

15. The implant of claim 1, wherein the tissue carrier matrix further includes at least one biological component.

16. The implant of claim 15, wherein the at least one biological component is selected from the group consisting of antibiotics, antimicrobial agents, anti-inflammatory agents, growth factors, growth factor fragments, small-molecule wound healing stimulants, hormones, cytokines, proteins, peptides, antibodies, enzymes, isolated cells, platelets, glycosaminoglycans, immunosuppressants, nucleic acids, analgesics, cell types, viruses, virus particles, and combinations thereof.

17. The implant of claim 16, wherein the at least one biological component comprises platelets, and further includes an activator of platelets.

18. The implant of claim 17, wherein the activator of platelets is selected from the group consisting of thrombin, calcium, adenosine di-phosphate (ADP), collagen, epinephrine, arachidonic acid, prostaglandin, ristocetin, retinoids, ascorbate, antioxidants, and combinations thereof.

19. The implant of claim 15, wherein the at least one biological component is a cell type, and further wherein the cell type is selected from the group consisting of osteocytes, fibroblasts, stem cells, pluripotent cells, chondrocyte progenitors, chondrocytes, osteocytes, osteoclasts, osteoblasts, endothelial cells, macrophages, adipocytes, monocytes, plasma cells, mast cells, umbilical cord cells, leukocytes, stromal cells, mesenchymal stem cells, epithelial cells, myoblasts, tenocytes, ligament fibroblasts, and bone marrow cells.

20. The implant of claim 15, wherein the at least one biological component is contained within the granules.

21. The implant of claim 15, wherein the at least one biological component is contained within a coating covering the granules.
22. A method of repairing a tissue defect or injury, comprising:
providing a tissue repair implant including a tissue carrier matrix comprising a plurality of biocompatible, bioresorbable granules and at least one tissue fragment in association with the tissue carrier matrix, the at least one tissue fragment having an effective amount of viable cells that can migrate out of the tissue fragment and populate the tissue carrier matrix; and
delivering the implant to a tissue site to be repaired.
23. The method of claim 22, wherein the step of delivering includes injecting the implant into the tissue defect site.
24. The method of claim 22, wherein the tissue carrier matrix includes a curing agent, and the method further includes the step of allowing the tissue repair implant to set at the tissue defect site.
25. The method of claim 22, wherein the tissue carrier matrix includes a curing agent, and the method further includes the step of allowing the tissue repair implant to set prior to delivering the tissue repair implant to the tissue defect or injury site.
26. The method of claim 22, wherein the at least one tissue fragment comprises a type that is the same as the tissue to be repaired.
27. The method of claim 22, wherein the at least one tissue fragment comprises a type that is different from the tissue to be repaired.
28. A method of preparing a tissue repair implant, comprising:
providing a tissue carrier matrix comprising a plurality of biocompatible, bioresorbable granules;

introducing a fluid suspension containing at least one tissue fragment to the tissue carrier matrix, the tissue fragment having an effective amount of viable cells capable of migrating out of the tissue fragment and into the tissue carrier matrix;

separating the at least one tissue fragment from the fluid suspension; and

collecting the tissue carrier matrix with the at least one tissue fragment for implantation at a tissue site to be repaired.

29. The method of claim 28, wherein the at least one tissue fragment is obtained from a connective tissue type selected from the group consisting of cartilage, meniscus, tendon, ligament, dermis, bone, fat, and combinations thereof.

30. The method of claim 28, wherein the at least one tissue fragment comprises autogeneic tissue, allogeneic tissue, xenogeneic tissue, and combinations thereof.

31. The method of claim 28, wherein the at least one tissue fragment has a particle size in the range of about 0.1 to about 2 mm³.

32. The method of claim 28, wherein the granules comprise a biocompatible material selected from the group consisting of aliphatic polyesters, copoly(ether-esters), solid copolymers of fatty acid esters of glycerol and succinic acid, polyoxaesters, collagen, gelatin, albumin, hyaluronate, glucosaminoglycans, polyanhydrides, polyphosphazines, subintestinal mucosa, acellular tissues, and combinations thereof.

33. The method of claim 32, wherein the granules comprise an aliphatic polyester selected from the group consisting of homopolymers or copolymers of lactides, glycolides, ϵ -caprolactone, p-dioxanone (1,4-dioxan-2-one), trimethylene carbonate (1,3-dioxan-2-one), and combinations thereof.

34. The method of claim 28, wherein an average maximum outer diameter of the granules is in the range of about 150 to about 600 μm .

35. The method of claim 28, further including the step of providing a binding agent in association with the tissue carrier matrix.

36. The method of claim 35, wherein the binding agent is selected from the group consisting of shark cartilage, alginate, hyaluronic acid, collagen gel, fibrin glue, fibrin clot, poly(N-isopropylacrylamide), agarose, chitin, chitosan, cellulose, polysaccharides, poly(oxyalkylene), a copolymer of poly(ethylene oxide)-poly(propylene oxide), poly(vinyl alcohol), polyacrylate, platelet rich plasma (PRP) clot, platelet poor plasma (PPP) clot, Matrigel, blood clot, gelatin-resorcin-formalin adhesives, mussel-based adhesives, dihydroxyphenylalanine (DOPA) based adhesives, transglutaminase, poly(amino acid)-based adhesives, cellulose-based adhesives, polysaccharide-based adhesives, synthetic acrylate-based adhesives, liquid and semi-solid fatty acid esters of glycerol and succinic acid (MGSA), MGSA/polyethylene glycol (MGSA/PEG) copolymers, polyvinylpyrrolidone (PVP), PVP copolymers, gelatin, albumin, monoglycerides, diglycerides, triglycerides laminin, elastin, proteoglycans, and combinations thereof.

37. The method of claim 36, further including the step of providing a curing-agent that crosslinks the binding agent and enables the implant to set.

38. The method of claim 37, wherein the curing agent is selected from the group consisting of thrombin, calcium, divinyl sulfone (DVS), polyethylene glycon divinyl sulfone (VS-PEG-VS), hydroxyethyl methacrylate divinyl sulfone (HEMA-DIS-HEMA), formaldehyde, glutaraldehyde, aldehydes, isocyanates, alkyl and aryl halides, imidoesters, N-substituted maleimides, acylating compounds, carbodiimide, hydroxychloride, N-hydroxysuccinimide, light, pH, temperature, metal ions, and combinations thereof.

39. The method of claim 28, further including the step of providing at least one biological component with the tissue carrier matrix.

40. The method of claim 39, wherein the at least one biological component is selected from the group consisting of antibiotics, antimicrobial agents, anti-inflammatory agents, growth factors, growth factor fragments, small-molecule wound healing stimulants, hormones,

cytokines, proteins, peptides, antibodies, enzymes, isolated cells, platelets, glycosaminoglycans, immunosuppressants, nucleic acids, analgesics, cell types, viruses, virus particles, and combinations thereof.

41. The method of claim 40, wherein the at least one biological component comprises platelets, and further includes an activator of platelets.

42. The method of claim 41, wherein the activator of platelets is selected from the group consisting of thrombin, calcium, adenosine di-phosphate (ADP), collagen, epinephrine, arachidonic acid, prostaglandin, ristocetin, retinoids, ascorbate, antioxidants, and combinations thereof.

43. The method of claim 40, wherein the at least one biological component is a cell type, and further wherein the cell type is selected from the group consisting of osteocytes, fibroblasts, stem cells, pluripotent cells, chondrocyte progenitors, chondrocytes, osteocytes, osteoclasts, osteoblasts, endothelial cells, macrophages, adipocytes, monocytes, plasma cells, mast cells, umbilical cord cells, leukocytes, stromal cells, mesenchymal stem cells, epithelial cells, myoblasts, tenocytes, ligament fibroblasts, and bone marrow cells.